

with the internal combustion engine;

a source of oxygen having a control valve providing fluid communication with the oxidizing catalyst bed; and

A1
a control system for conditioning the oxidizing catalyst bed prior to receiving significant amounts of exhaust having a component selected from [HCs, CO or] hydrocarbons, carbon monoxide, and combinations thereof, conditioning the reducing catalyst bed prior to receiving significant amounts of exhaust having NO_x, and providing hydrogen to the internal combustion engine during cold start.

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5.(Amended) The system of claim 1, wherein the reducing catalyst is conditioned selectively continuous[ly] or discontinuous[ly] throughout operation of the internal combustion engine.

6.(Amended) The system of claim 1, wherein the oxidizing catalyst bed is selected from a two-way catalyst[,], and a three-way catalyst [or combinations thereof].

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8.(Amended) The system of claim 1, wherein the reducing catalyst [monolith] bed includes essentially no catalyst [capable of] for oxidizing nitrogen.

9.(Amended) The system of claim 1, wherein the [hydrogen] source of hydrogen includes an on-board electrolyzer.

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11.(Amended) The system of claim 1, wherein the third control valve provides hydrogen [is provided] to the internal combustion engine during cold start [by opening the third hydrogen control valve].

12.(Amended) A method for preventing and treating [emissions in] exhaust gas from an internal combustion engine, comprising:

supplying hydrogen fuel to an internal combustion engine during cold start;
passing the exhaust gas over one or more oxidizing catalysts and then over one or more reducing catalysts;

oxidizing one or more oxidizable components in the exhaust gas over the one or more oxidizing catalysts;

providing hydrogen gas [in]to the one or more reducing catalysts; and

reducing one or more reducible components in the exhaust gas over the reducing catalysts.

13.(Amended) The method of claim 12, wherein the one or more reducing catalysts [is] are selected from Pt, Ru, Pt-alloys, Ru-alloys and combinations thereof.

14.(Amended) The method of claim 12, [further comprising: providing hydrogen to the reducing catalysts; and reducing] wherein the one or more reducible components comprises a nitrogen oxide[s] , and wherein the nitrogen oxide is reduced to nitrogen gas and water vapor at the one or more reducing catalysts.

15.(Amended) The method of claim 12, wherein the one or more oxidizable components are selected from hydrocarbons, carbon monoxide [or] and combinations thereof and the one or more reducible components includes a nitrogen oxide[s].

16.(Amended) The method of claim 12, wherein the internal combustion engine burns a fuel selected from gasoline, diesel, natural gas [or] and methanol after cold startup.

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~~17~~.(Amended) The method of claim 12, wherein the hydrogen is provided to the one or more reducing catalysts only after an engine warm-up period.

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~~18~~.(Amended) The method of claim ²⁰~~17~~, wherein the hydrogen is substantially continuously provided to the one or more reducing catalysts after the engine warm-up period.

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~~19~~.(Amended) The method of claim 12²⁰[7], wherein the hydrogen is provided to the one or more reducing catalysts before an engine warm-up period to condition the one or more reducing catalysts prior to introducing nitrogen oxides.

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20. (Amended) The method of claim 16, further comprising:

providing hydrogen and oxygen to the one or more oxidizing catalysts at a time selected from before the internal combustion engine is started [or] and before the exhaust gas stream contacts the one or more oxidizing catalysts.

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21. (Amended) The method of claim ¹⁷20, further comprising:

heating the one or more oxidizing catalysts by exothermic catalytic combination of hydrogen and oxygen up to a light-off temperature.

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22. (Amended) The method of claim ¹⁷20, wherein [after the engine warm-up period] the hydrogen is substantially continuously provided to the one or more reducing catalysts after the engine warm-up period.

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25. (Amended) The method of claim ²⁷24, wherein [after the engine warm-up period] the hydrogen is substantially continuously provided to the one or more reducing catalysts after the engine warm-up period.

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26. (Amended) The method of claim ²⁷24, wherein [after the engine warm-up period] the hydrogen is discontinuously provided to the one or more reducing catalysts after the engine warm-up period.

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27. (Amended) The method of claim 12, further comprising:

heating the one or more oxidizing catalysts by exothermic catalytic combination of hydrogen and oxygen up to a light-off temperature.

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28. (Amended) The method of claim 12, further comprising:

providing hydrogen to the one or more reducing catalysts before the exhaust gas stream contacts the one or more reducing catalysts.